

REMARKS

Claims 1-35 are pending. Claims 28-35 are withdrawn from consideration.

Claims 1, 16 and 22 are independent claims. Applicant respectfully requests favorable reconsideration in light of the remarks that follow.

Initially, page 2 of the Office Action states that the drawings have been entered. However, Applicant notes that in the Office Action Summary section on page 1, item 10 only indicates that drawings were submitted on March 8, 2004, and does not explicitly acknowledge their acceptance. For clarity and consistency reasons, Applicant respectfully requests that the Examiner indicate in a next communication that the drawings have been accepted.

Claims 1-8 and 22-25 have been rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent 5,973,444 (*Xu et al.*) in view of U.S. Patent 6,628,053 (*Den et al.*); Claims 9, 10, 13-15, 26 and 27 as being obvious over U.S. Patent 5,847,495 (*Yamanobe et al.*) in view of *Xu et al.* and *Den et al.*; and Claims 11, 12, and 16-21 as being obvious over *Yamanobe et al.* in view of *Xu et al.*, *Den et al.*, and U.S. Patent 5,066,883 (*Yoshioka et al.*).

Claim 1 is directed to an electron-emitting device comprising (A) fiber and (B) a layer including a metal-oxide semiconductor. The fiber is comprised of carbon as a main ingredient. The layer including a metal-oxide semiconductor has the metal-oxide thereof selected from the group consisting of titanium oxide, zirconium oxide, and niobium

oxide. Furthermore, the fiber is disposed on the layer and partially contains Pd.

Claim 16 is directed to an electron-emitting device comprising first and second electrodes disposed with a gap on a surface of a substrate, a plurality of fibers each comprising carbon as a main ingredient electrically connected with the first electrode, means for applying to the second electrode a voltage higher than a voltage applied to the first electrode, and a layer including a metal-oxide semiconductor. The layer is disposed between the first electrode and the plurality of fibers. Ends of the plurality of fibers are higher than a surface of the second electrode from the surface of the substrate, and the metal-oxide of the metal-oxide semiconductor is selected from the group consisting of titanium oxide, zirconium oxide and niobium oxide.

Claim 22 recites features that are similar in many respects to those of Claim 1, but recites that the fiber includes a plurality of layered graphens.

Notably, each of Claims 1, 16 and 22 recites a feature where a metal-oxide is selected from the group consisting of titanium oxide, zirconium oxide, and niobium oxide, in an electron-emitting device layer that includes a metal-oxide semiconductor.

As previously discussed in the Amendment dated August 28, 2003 and the Amendment After Final Rejection dated March 4, 2004, *Xu et al.* relates to carbon fiber-based field emission devices and discloses that carbon fiber emitters for field emission devices are catalytically grown onto a selected area of a device surface. An insulating layer, such as silica or alumina, is used as a catalyst support material (see column 7, lines 52-58). *Xu et al.* also discloses that fibers can contain portions of the catalyst; for example,

a fiber may contain at least one transition metal or a compound or alloy thereof.

Additionally, *Xu et al.* discloses that the transition metal may be Fe, Co, Ni, Cr, Mn, Mo, W, Re, Ru, Os, Rh, Ir, Pd, Pt, Zn, or Cu (see col. 9, lines 25-39).

On page 3 of the Office Action, the Examiner correctly states that “Xu does not appear to specify the use of Ti as the component of the oxide semiconductor growth surface....” However, for the reasons that follow, Applicant respectfully disagrees with the Office Action’s position that *Den et al.* “discloses the use of Titanium and Titanium Oxide as a growth structure for a carbon nanotubes[, and] discloses the use of a titanium conductor (21) and titanium oxide (22) formed in the process of creating the growth sites that are combined in the semiconductor layer (25) of Figure 5a-5c. (Column 7 lines 30-60).”

Applicant submits that nothing in *Den et al.* would disclose or suggest the use of a titanium conductor and titanium oxide as a semiconductor layer 25, as stated in the Office Action. At column 7, lines 30-60 of *Den et al.*, Figs. 5A, 5D and 6A-6D are described. Also, column 7, lines 55-60 states that “FIG. 5C is an embodiment in which the wall 22 and the conductive surface 21 comprise a semiconductor wall 25, and FIG. 5D is an embodiment in which the support 20 having the conductive surface 21 and the wall 22 comprise a semiconductor wall 25.” (See column 7, lines 55-60 with reference to Figs. 5C and 5D). Thus, *Den et al.* discloses in the particular passage cited by the Office Action (column 7, lines 30-60 with reference to Figs. 5C and 5D) that a semiconductor wall 25 is

used. However, nothing in this passage of *Den et al.* would disclose a titanium conductor and titanium oxide combination.

Moreover, in *Den et al.* the material used in semiconductor layer 25, is n-type silicon or p-type silicon. This is evidenced in column 8, lines 64-67 where *Den et al.* states “[i]n the carbon nanotube device having in configuration shown in FIG. 5B, 5C, 5D or 6D, for example, a p-type silicon or a n-type silicon semiconductor support is suitably applicable.”

At column 8, lines 15-26, *Den et al.* states

FIG. 6D covers an embodiment in which the support 20, the conductive surface 21 and the wall 22 comprise a semiconductor 25 wall, and an insulating layer 35 is formed on the surface thereof. All these embodiments, indicate a tunnel junction, and the optimum insulating layer thickness depends upon the driving voltage, the composition and structure of the insulating layer 35. The thickness of the insulating layer 35 should preferably be within a range of from a sub-nm to several tens of nm, or more specifically, from 1 to 10 nm. The composition of the insulating layer 35 may comprise, for example, silicon oxide, titanium oxide, or alumina. (Emphasis added).

Thus, *Den et al.* discloses an insulator 35 that may contain titanium oxide, in the embodiment shown in Fig. 6D.

In view of the foregoing, Applicant submits that *Den et al.* does not disclose or suggest a titanium conductor (21) and titanium oxide (22) formed in the process of creating the growth sites that are combined in the semiconductor layer (25) of Figure 5A-5C, as stated in the Office Action.

Indeed, nothing in *Den et al.* would teach or suggest “a layer including a metal-oxide semiconductor, wherein the metal-oxide thereof is selected from the group consisting of titanium oxide, zirconium oxide, and niobium oxide,” as recited in Claims 1 and 22. Neither is *Xu et al.* seen to teach or suggest those features.

Accordingly, Applicant submits that Claims 1 and 22 are patentable over those references, whether considered separately or in combination.

Regarding independent Claim 16, for the reasons given above, *Xu et al.* and *Den et al.* do not disclose or suggest the feature of “a layer including a metal-oxide semiconductor, wherein the metal oxide thereof is selected from the group consisting of titanium oxide, zirconium oxide, and niobium oxide,” as recited in Claim 16.

The Office Action cites *Yamanobe et al.* for disclosing the use of a step portion 21 under the first electrode to raise the electrode higher than the second electrode and *Yoshioka et al.* for disclosing the use of directly etching the substrate in order to create a step portion and raise the first electrode. However, it is respectfully submitted that nothing in either reference would teach or suggest the above-quoted feature of Claim 16.

As such, Claim 16 is believed to be patentable over *Yamanobe et al.*, *Xu et al.*, *Den et al.*, and *Yoshioka et al.*, whether considered separately or in any permissible combination thereof.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of

the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100 or by facsimile at (212) 218-2200. All correspondence should continue to be directed to our address given below.

Respectfully submitted,



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